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# WATER QUALITY

# Information on Salinity Control Projects in the Colorado River Basin

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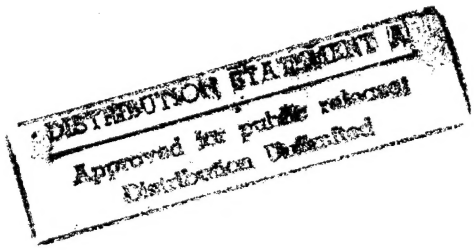

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here to discuss our recent report on projects to control salinity in the Colorado River Basin.[1] Title II of the Colorado River Basin Salinity Control Act of 1974, and amendments to the act in 1984, authorized such projects within the Department of the Interior's Bureau of Reclamation (BOR) and Bureau of Land Management (BLM), and within the U.S. Department of Agriculture (USDA). Our work was done for the Ranking Minority Member of the House Committee on Resources and the Ranking Minority Member, Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies, House Committee on Appropriations. Our report provides information on (1) the projects' cost, (2) factors the agencies consider in selecting salinity control methods, and (3) measurements of the salinity control program's effectiveness.

In summary, through fiscal year 1994, the agencies had spent a total of about $362 million on salinity control projects located in six states.[2] BOR and USDA estimate that they will spend about $428 million more for additional projects, whereas BLM expects to spend $800,000 in fiscal year 1995. In selecting salinity control methods, the agencies consider several factors, key among them the method's effectiveness and cost. According to Interior's measurements of the salinity control program's effectiveness, salinity levels in the Colorado River since 1974 have been below the limits established under the Clean Water Act. With completion of the projects under construction or planned, according to reports on the salinity program, salinity levels should remain within the established limits beyond 2010.

Before discussing these matters in more detail, we would like to provide some background information.

## BACKGROUND

The salinity of the Colorado River increases dramatically as the river makes its 1,400-mile journey from its headwaters in Wyoming and Colorado to its termination in Mexico. Nearly half of the salinity is caused by nature--when, for example, groundwater flows through salt formations and enters the river or when saline springs contribute their salt to the river. But another major contributor to the river's salinity is the use of the water for agriculture. Simply put, when water is diverted from the river for irrigation, the river's salinity increases as the level of water is depleted. Some of the diverted water, once

[1]Water Quality: Information on Salinity Control Projects in the Colorado River Basin (GAO/RCED-95-58, Mar. 29, 1995).

[2]Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming.

applied to crops, then seeps into the ground, picks up salt from the soil, and returns--now with a much higher saline content--to the river. Because less water remains in the river to dilute the salt, salinity increases.

Two major pieces of legislation address the salinity of the Colorado River. The first, the Clean Water Act, as amended (33 U.S.C. 1251, 1313), requires national standards for water quality. In response to the requirements of this act, the Environmental Protection Agency (EPA) approved numeric criteria for salinity levels at three monitoring stations along the Colorado River.[3] The salinity of the water passing these stations is not supposed to exceed these criteria. Furthermore, as part of its treaty of February 3, 1944, and an agreement of August 30, 1973, with the Republic of Mexico, the United States agreed to take measures to ensure that the water flowing into Mexico from the Colorado River would have an average annual salinity concentration based on that of the Colorado River water arriving at the Imperial Dam.[4] The Imperial Dam, near Yuma, Arizona, is the last U.S. station at which salinity standards have been set before the river enters Mexico.

The second act, the Colorado River Basin Salinity Control Act of 1974, as amended (43 U.S.C. 1571, 1591), was passed to enhance and protect the quality of water delivered to users in the United States and Mexico. Title II of the act authorized the Secretary of the Interior, through BOR, to proceed with the construction of four specific salinity control projects and to continue planning several other projects. The 1984 amendments to the act required BLM, and authorized USDA, to implement salinity control programs. The amendments also authorized BOR to construct two additional salinity control projects and deauthorized one of the previously authorized projects.

The objective of the salinity control program is to decrease the salinity of the Colorado River by preventing salt from washing directly into it or percolating through the soil and entering it. Among the methods used are (1) lining irrigation

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[3]The three monitoring stations are located (1) below Hoover Dam, at the southern border of Nevada; (2) below Parker Dam, at the western edge of central Arizona; and (3) above Imperial Dam, near Yuma, Arizona.

[4]Specifically, Minute No. 242 of the International Boundary and Water Commission, United States and Mexico, states that the salinity concentration of Colorado River water entering Mexico will not exceed, by more than 115 parts per million (plus or minus 30) of total dissolved solids, the average annual salinity concentration of the water at the Imperial Dam.

delivery systems, such as canals and laterals (ditches that carry water to plots of land); (2) controlling sources of strong saline solutions, or brine, either by pumping the brine into wells below the water table or by plugging its source; (3) controlling the erosion of saline soils; and (4) improving or modernizing agricultural irrigation systems to reduce the amount of irrigation water used, in turn reducing the amount of salt contributed to the river.

## COST OF SALINITY CONTROL PROJECTS

By the end of September 1994, BOR, BLM, and USDA had spent a total of about $362 million on salinity control projects. BOR had completed construction of 3 of its 10 salinity control projects; the remaining 7 were in various stages of planning or construction. BLM had controlled salinity through projects specifically devoted to this purpose as well as through multipurpose projects. USDA had implemented salinity control projects on farms in cooperation with individual farmers.

### Bureau of Reclamation

Through September 30, 1994, the Congress had authorized BOR to spend up to $301 million on constructing salinity control projects, of which $266 million had been expended. (The authorization total, or ceiling, has been increased each year to reflect inflation.) BOR's projects generally reconstruct primary irrigation systems, which involves lining irrigation canals and ditches with concrete or plastic. Other projects block or control specific "point" sources of salinity; for example, in one project, brine is injected into a deep well to prevent its entering the river.

By the end of September 1994, BOR had completed construction of three salinity control projects, at a combined cost of about $69 million. Construction was under way on another three projects, and the remaining four projects were in various stages of planning. According to BOR program managers, completing the unfinished and currently planned projects will cost about $200 million.

### Bureau of Land Management

From 1984 through September 30, 1994, BLM had spent about $7 million on its salinity control program. BLM generally incorporates salinity control objectives in its multipurpose resource land management plans, which describe management alternatives for all resources on and uses of the 270 million acres of public land that the agency manages. As part of its multipurpose land management, BLM has built structures in gullies and has improved ground cover to prevent soil from washing away during heavy thunderstorms. Additionally, BLM has undertaken

specific salinity control projects, such as plugging abandoned oil and gas wells that were known sources of salt. According to the coordinator of BLM's salinity control program, information on the specific number of salinity control projects and their costs was not readily available. However, according to the coordinator, BLM has undertaken at least 14 such projects. For fiscal year 1995, BLM expects to spend about $800,000 on salinity control.

U.S. Department of Agriculture

Through September 30, 1994, USDA had spent about $89 million on its salinity control program. The program, in which farmers participate voluntarily, emphasizes the use of efficient irrigation methods to reduce water seepage. Through this program, USDA primarily (1) identifies sources of salt and develops remediation plans; (2) provides financial and technical assistance to farmers to plan, undertake, and maintain projects that reduce seepage; and (3) monitors and evaluates the effectiveness of such projects and practices. USDA funds 70 percent of the cost of the salinity control projects; the landowners fund the remaining 30 percent.

Through September 30, 1994, USDA had about 1,300 contracts for salinity control projects on farms in five project areas in Colorado, Utah, and Wyoming. These projects generally involve installing underground pipelines; lining earthen ditches, canals, and laterals; leveling land to reduce runoff; and replacing conventional irrigation systems with more efficient ones. These projects have affected a total of about 150,000 acres, or about 40 percent of the approximately 360,000 acres targeted for treatment by USDA. According to USDA program managers, it will cost about $228 million more to complete projects in the five project areas where projects are currently underway.

## PROGRAM MANAGERS CONSIDER VARIOUS FACTORS IN SELECTING PROJECTS' METHODS

In their search for viable ways to control the amount of salt being added to the Colorado River, program managers have considered a variety of methods specific to each site. In selecting a particular salinity control method from among the available alternatives, these managers consider several factors, including the various methods' cost and effectiveness, as well as their feasibility and effects on the environment.

To compute a method's cost-effectiveness, BOR and USDA divide the method's estimated annualized cost by the tons of salt it is expected to control annually, yielding the cost of

preventing 1 ton of salt from entering the river.[5] BLM does not compute cost-effectiveness, largely because of the multipurpose nature of their projects, which include salinity control objectives. Essentially, in the formula used by BOR and USDA, annualized costs are composed of capital costs as well as operations and maintenance costs. The total capital cost is annualized by amortizing it using an 8-percent interest rate over the life of the project.

The cost-effectiveness of BOR's projects ranges from $5 per ton to $138 per ton. The variance in cost-effectiveness, according to BOR's Salinity Control Program Coordinator, stems from many things, such as the number and type of activities involved, the size and complexity of the project, and advances in technology (e.g., using a strong, thin plastic membrane rather than concrete to line canals or laterals). The cost-effectiveness of USDA's projects ranges from $29 per ton to $70 per ton.

In addition to cost-effectiveness, program managers also consider other factors that may lead to rejecting a method. For example, retiring land from agricultural use has generally been considered an unacceptable method of controlling salinity, primarily because of the adverse effect on the local economy of such an action. In another example, BOR program managers considered piping brine into a holding pond and letting it evaporate, but rejected the method because it was deemed dangerous to wildlife in the area.

## INTERIOR'S MEASUREMENTS OF SALINITY SHOW THAT STATUTORY LIMITS ARE NOT BEING EXCEEDED

According to an Interior report,[6] natural variations in the Colorado River, due to highly variable runoff and flows, cause salinity levels to vary significantly. The salinity control program is not intended to counteract the salinity fluctuations that result from the highly variable runoff and flows caused by climatic conditions, precipitation, snowmelt, and other natural factors. Rather, the program is designed to offset the effects of development, even as salinity varies from year to year in response to the climatic and hydrologic conditions.

Interior's measurements of salinity since the inception of the program show that salt levels at the three monitoring stations have remained below the limits established under the

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[5]We did not evaluate this formula as a measure of cost-effectiveness.

[6]Quality of Water, Colorado River Basin, U.S. Department of the Interior, Progress Rpt. No. 16 (Jan. 1993).

Clean Water Act. Salinity program reports concluded that, with the completion of projects under construction or planned, salinity levels should remain within these limits beyond 2010. Without these additional salinity control projects, according to BOR's projections, the salinity levels at Imperial Dam would exceed the established limits by about 2000, with steadily increasing levels thereafter.

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Mr. Chairman, this concludes our statement. We would be glad to respond to any questions that you or other members of the subcommittee may have.

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